Local Scale Monitoring Methods & Equipment

Wet Tropics Major Integrated Project

Putting local knowledge into reef action

How water monitoring efforts are contributing to a bank of information about how, when and where nutrients, sediments and pesticides are moving, so we can look for ways to improve water quality leaving the catchment.

Solar, flume and platform

Paddock Monitoring

A close look at how water quality changes as it moves across the paddock

Paddock run-off monitoring

Why?

Many factors, like rainfall, soil type and management practices, influence how nutrients, soil particles and pesticides behave in the paddock. Paddock monitoring tells us how much of these pollutants are running off the surface of a farm paddock when it rains.

How?

- A weather station records rainfall information, so we can see how much local rainfall it takes to create runoff.
- We channel the water moving across the paddock through a narrow structure (a "flume") and measure the depth. We can then calculate how much and how quickly the water is running off the paddock.
- Automatic sampling equipment sits on a platform above the flume to keep it out of the wet zone. It takes regular water samples from the flume when it rains. The equipment is refrigerated to keep the samples stable until we collect and analyse them to see what is running off the paddock.
- The system is solar-powered and also has back-up batteries. It's connected to our computer so we can see what's happening at the site – what the weather is like and when the samples are being taken.
- Time lapse cameras at the sites also keep track of what's happening out there!

Water sample carousel in refrigerated autosampler

Time lapse camera

Shallow groundwater monitoring

Why?

Nutrients are soluble and move easily. They are sometimes lost from the paddock before the crop has a chance to use them. We can track changes in nutrient concentrations below the root zone, where they are no longer accessible to the crop. This helps us to start thinking about the relationship between paddock management practices, rainfall and changes in water quality.

How?

- We use a groundwater bore (a piezometer or "piezo") with a porous casing going down a few metres to collect water that has trickled down beyond the root zone.
- Every fortnight, we take samples for analysis by pumping all the water out of the piezo three times, allowing it to re-fill between purges, and then pumping up a final sample to send to the lab.

Bioreactor piezo

Purging the piezo

Groundwater monitoring at bioreactor site

Sub Catchment Monitoring

Tracks how water quality changes as it moves down the creek system through different land uses and land types

Routine grab sampling

Why?

Different land uses have different impacts on water quality. We take regular manual samples at strategically located sites. The information on the water's physical and chemical parameters helps us answer the question about the impact of different land uses, including rainforest, agriculture and urban, on water quality.

How?

- Manual water samples ("grab" samples) are taken from the same sites on a regular basis – monthly in drier months and fortnightly during the wet season.
- We analyse these samples in a lab, looking for dissolved and total nutrients, total suspended sediments and pesticides.
- A handheld multi-parameter instrument measures nitrate, dissolved oxygen, pH (acidity), turbidity (cloudiness), electrical conductivity and depth. These are used to assess aquatic ecosystem health.
- We also record what we see at the site, like flow conditions, algal blooms, and dead animals, which gives us context and helps support interpretation of the results.

Sample bottles

Handheld multiparameter instrument

Event-based monitoring

Why?

When we get heavy, sustained rain (an "event"), nutrients, soil particles and pesticides can be washed into waterways. We see this especially at the start of the wet season. Monitoring during high rainfall helps us understand how these big runoff and stream flow events influence water quality as they pick up fertilisers and pesticides.

How does it work?

- We take manual grab samples at designated sites along the stream bank when the streams start to rise substantially, and then again as the flow subsides. We send them to a lab to look for the total and dissolved nutrients, total suspended sediments, and pesticides.
- "Rising stage" sampler units help out when we can't get to the sites to take manual samples (for example, if the stream rises overnight or conditions are too dangerous). The samplers are fixed at different levels up a stream bank and as the water level rises, water flows into the sample bottle and is stored safely in the bottle through an air lock system until the water level falls again and someone can retrieve the sample.

Rising stage samplers and depth logger

In-stream continuous monitoring

Why?

Water quality in the creek can change very quickly, within hours or even minutes. In-stream continuous monitoring automatically measures a range of parameters every half hour, giving us a better picture of changes in water quality over time compared to manual sampling. This kind of technology is relatively new and uses a range of complex equipment.

How?

- Before monitoring starts, we measure the cross section of the creek so we can establish the relationship between stream height and flow.
- Water is pumped from a creek into a flow-through cell housed on a platform. (The platform keeps the electrical equipment out of the flood zone!) A probe sits in the flow-through cell and is programmed to take measurements of nitrate, pH (acidity), electrical conductivity, turbidity (cloudiness) and dissolved oxygen levels.
- Every time the probe takes a measurement, another instrument called the "Amazon Bubbler" measures stream height. We can then calculate the volume of water in the stream and estimate the pollutant loads.
- A rain gauge and weather station at each site record rainfall, barometric pressure, humidity, wind speed and direction, and air temperature. This gives us information about small, localised weather events happening in the areas we're monitoring.

In-situ monitoring infrastructure

In-situ monitoring inside the box

On-the-spot nitrate measuring

Why?

Equipment like benchtop photometers and handheld multi-parameter instruments are portable instruments that can give rapid, on-the-spot measurement of nitrate concentrations. They're not as accurate as lab analysis but are a useful demonstration tool, especially when there are big differences in nitrate concentrations at different locations.

How?

- When we use a photometer, we add a reagent to the water sample, put it into the machine and wait a few minutes while the added chemical reacts with the nitrate in the water and changes colour. The nitrate content of the water displays on the screen.
- A handheld multi-parameter instrument has a sensor that is dipped manually into water. It measures nitrate, dissolved oxygen, pH, turbidity and electrical conductivity, and displays the results on screen immediately.

Multiparameter instrument sensors

Benchtop photometer

Suzette grab sampling

End of catchment sampling site at Euramo

End of Catchment Monitoring

The big picture

Why?

End-of-catchment monitoring sites are managed by the Queensland Government. The water has travelled down the river system and has picked up contributions from all the different land types and uses along the way. This sampling helps to track of the long term trends in water quality entering the Great Barrier Reef lagoon, and the overall catchment progress towards Reef 2050 water quality targets.

How?

- Sampling points are located at the lowest practical point of the river, generally above the tidal influence. On the Johnstone River that's Coquette Point, and on the Tully River it's at Euramo.
- Routine grab sampling occurs either weekly or monthly depending on the time of year and what is being analysing.
- More intensive monitoring takes place during high flow events, using automatic samplers.
- Samples are sent to the lab for an analysis of nutrients, total suspended sediments and pesticides.
- A sonde (probe) measures nitrate levels, total suspended sediment, turbidity and electrical conductivity.
- At Coquette Point there are also instruments in place to measure river flow and height, and at Euramo, river height.

Refrigerated sampler

End of catchment sampling housing at Euramo

www.terrain.org.au/mip

This project is funded by the Queensland Government through the Queensland Reef Water Quality Program

Wet Tropics Major Integrated Project

Putting local knowledge into reef action